

**ENERGY AND LIFE PROCESSES**  
**On-Level Seventh Grade Science**  
**2011-2012**

**Description**

The sun is the center of our solar system. Without the sun, our solar system would not exist. Earth is unique among all planets in the solar system. Its distance from the sun ensures that temperature conditions on Earth will support life. Earth has an atmosphere and water which are also characteristics of a planet that will support life. Ecosystems on Earth consist of all the living (biotic) and nonliving (abiotic) components in a specific area. Recycling of biotic and abiotic materials ensure that nutrients necessary to support life are continually available.

Energy from the sun is used by plants (producers) to produce food through the process of photosynthesis. Producers comprise the first trophic level in an ecosystem's energy pyramid; thus organisms at all trophic levels are indirectly reliant on the sun for the energy needed for survival. Ten percent of the energy available at this first trophic level is passed on to first-order consumers at the next trophic level. Second- and third-order consumers comprise the last two trophic levels of the energy pyramid. At each level, only ten percent of the energy available at the previous level is passed on. Other energy is transformed to support life processes of the organisms (e.g., digestion, growth, temperature regulation) or otherwise changed during natural events (e.g., decomposition). Energy transfer in an ecosystem can be graphically represented using food webs; food webs are multiple interconnected food chains. Emphasis is on tracing the flow of energy through an ecosystem using graphic representations.

**Connections**

Energy from the sun is what makes Earth unique in its ability to support life. Energy cannot be created or destroyed, only transformed or transferred. Energy of motion is discussed in a previous unit. Energy and its use for life processes will be discussed in relationship to chemical processes that occur within human body systems in a later unit. Adaptations of organisms make them especially well-suited for life in specific ecosystems, and are discussed in a previous unit.

**Enduring Understandings**

1. The make-up of our solar system make space exploration possible.
2. Earth is the only planet in our solar system with characteristics necessary to support life. These characteristics include water, an atmosphere, and optimal distance from the Sun.
3. Energy from the Sun is the basis for life on Earth.
4. Ecosystems are comprised all biotic and abiotic factors in an area and the interactions between them.
5. Energy is constantly cycled through an ecosystem.
6. Energy pyramids illustrate distribution of energy within an ecosystem.
7. Food webs illustrate transfer of energy within an ecosystem.
8. Plants (producers) are the foundation of all energy pyramids and food webs. Plants make their own food using water, carbon dioxide, and energy from the sun in a process called photosynthesis.
9. Decomposers play an important role in the recycling of nutrients in an ecosystem.

**Essential Questions**

1. Why is exploration of our solar system possible?
2. What features of our solar system make it possible for Earth to sustain life?

3. How does energy from the Sun support life?
4. What factors comprise an ecosystem?
5. How is energy transferred within an ecosystem?
6. What role do producers, consumers, and decomposers play in an ecosystem?
7. What is photosynthesis and how is it related to energy transfer in an ecosystem?

### **Essential Concepts and Skills**

By the end of the unit, the student is expected to:

1. identify characteristics of our solar system that make space exploration possible
2. analyze the importance of the Sun to Earth's ability to sustain life
3. formulate a list of Earth's characteristics that make life possible
4. evaluate the efficiency of energy transfer within an ecosystem
5. produce a food web given information about organisms in an ecosystem
6. predict and justify what would happen to an ecosystem if all the decomposers became extinct
7. create an energy pyramid showing organisms present at each trophic level
8. construct a diagram to show how photosynthesis transforms water, carbon dioxide and energy from the Sun into usable food

### **What do students typically have as misconceptions?**

1. Stronger organisms have more energy.
2. There are more herbivores because they have more offspring.
3. A species high on the food web is a predator to everything below it.
4. Energy accumulates in an ecosystem so that a top predator has all the energy from the organisms below it.
5. Carnivores can exist in a plant free world if their prey reproduce enough.

### **Preconception Survey**

1. What happens to energy from the sun once it reaches Earth?
2. What relationship is there between sunlight, plants and animals?
3. What happens to energy once an organism dies?

### **Formative Assessment Items**

1. Plan a trip to Mars taking into account the length of the trip, life essentials, and recycling of waste.
2. Simulate predator/prey relationships and analyze the relationships between population sizes.
3. Use a Venn diagram to compare and contrast food web diagrams and energy pyramids.
4. Investigate photosynthesis under varying conditions using *Elodea* and indicator solutions.

### **TEKS Covered**

**7.5 Matter and energy.** The student knows that interactions occur between matter and energy. The student is expected to:

- A) recognize that radiant energy from the Sun is transformed into chemical energy through the process of photosynthesis.
- B) demonstrate and explain the cycling of matter within living systems such as in the decay of biomass in a compost bin.

- C) diagram the flow of energy through living systems, including food chains, food webs, and energy pyramids. ***Supporting Standard-Category 1***

**7.9 Earth and space.** The student knows components of our solar system. The student is expected to:

- A) analyze the characteristics of objects in our solar system that allow life to exist such as the proximity of the Sun, presence of water, and composition of the atmosphere.
- B) identify the accommodations, considering the characteristics of our solar system that enabled manned space exploration.

**6.11 Earth and space.** The student understands the organization of our solar system and the relationships among the various bodies that comprise it. The student is expected to:

- B) understand that gravity is the force that governs the motion of our solar system.  
***Supporting Standard-Category 3***

**Vocabulary**

biotic, abiotic, producers, consumers, decomposers, photosynthesis, trophic levels, food chain, food web, energy pyramid, first-order consumer, second – and third level consumers, carnivore, herbivore, omnivore, predator, prey, biomass